

Mobile Greenhouse Test Facility Design for Analogue Testing at the German Neumayer III Antarctic Station

Paul Zabel - German Aerospace Center

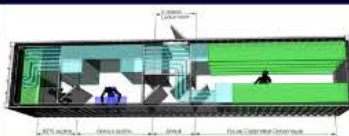
Research and development objectives

1. Manufacturing a space analogue mobile test facility
2. Validation of greenhouse module subsystems and key technologies
3. Study of microbial behaviour and countermeasures
4. Demonstrate operation techniques and processes for higher plant cultivation

Antarctic analogue features

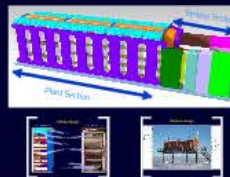
- Crew size**
Overwintering (9-10 months) (crew size similar to space missions)
- Crew dynamics**
Effects on the psychological well-being of the crew are comparable
- Extremely low biodiversity environment**
Antarctica is one of the most protected and biologically sparse environments on Earth
- Inhabitable environment**
High winds, heavy snowfall, very low temperatures, seasonal dark periods
- Habitat interface**
Similar logistics, power limitations, data transfer limitations, waste and water handling

Opportunity



Greenhouse facility design

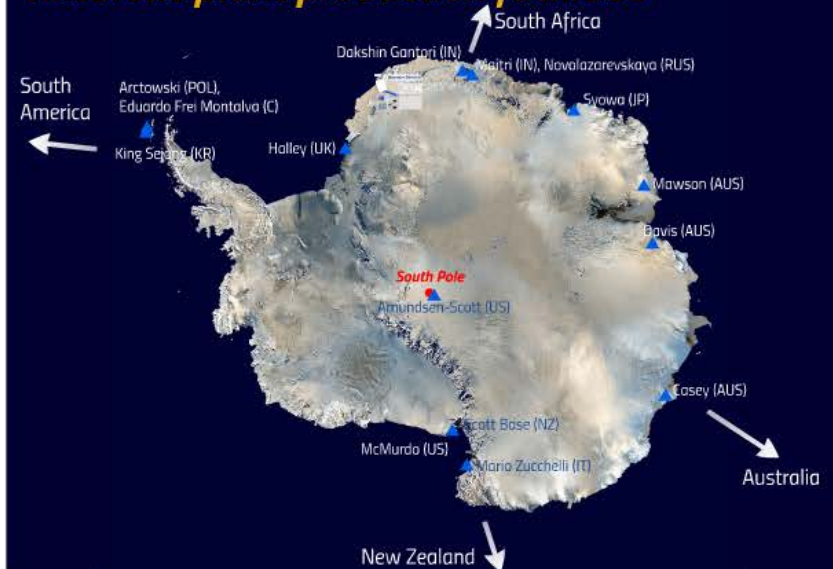
Internal dimensions: 40 ft x 12 ft x 2.35 x 2.70 meters
Insulation assumed: 80 mm
Separate plant and service section
Internal configuration: 18 grow units (720 x 970 x 2500 mm)



**Thank you
for your attention!**



Antarctic plant production facilities



Opportunity
EDEN ISS proposal to the EU within
Horizon 2020 COMPET-7 2014

Partners:

ThalesAlenia Space, Airbus, Telespazio, AWI, SAB, NASA, CEAC, CHA-PALE, and others.

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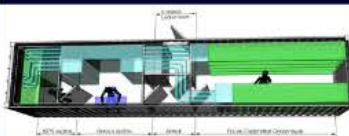
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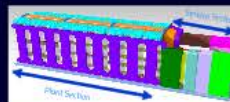
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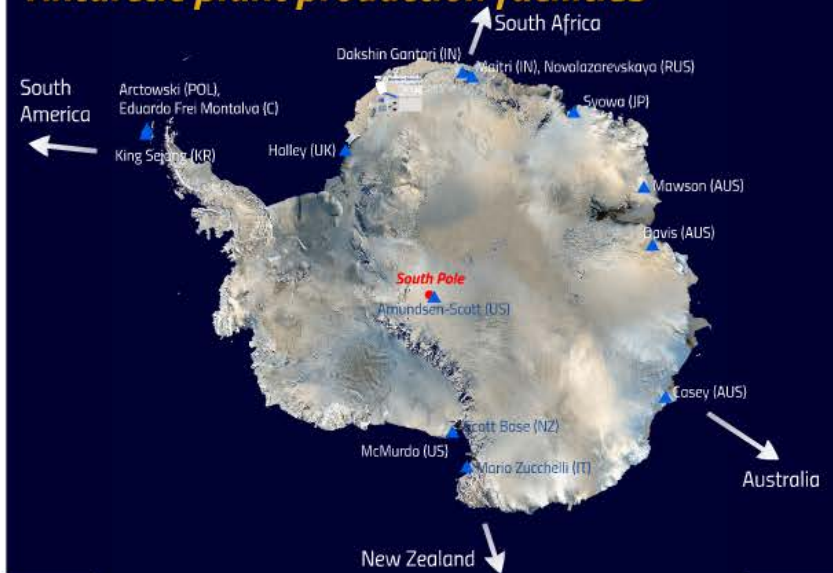


Greenhouse facility design

Internal dimensions: 4.0 ft x 12.02 x 2.35 x 2.70 meters
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Antarctic plant production facilities



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Partners:

- ThalesAlenia Space
- University of Cologne
- Airbus
- Telespazio
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- ESA
- CEAC
- CHARRLE

SAB:

- NASA
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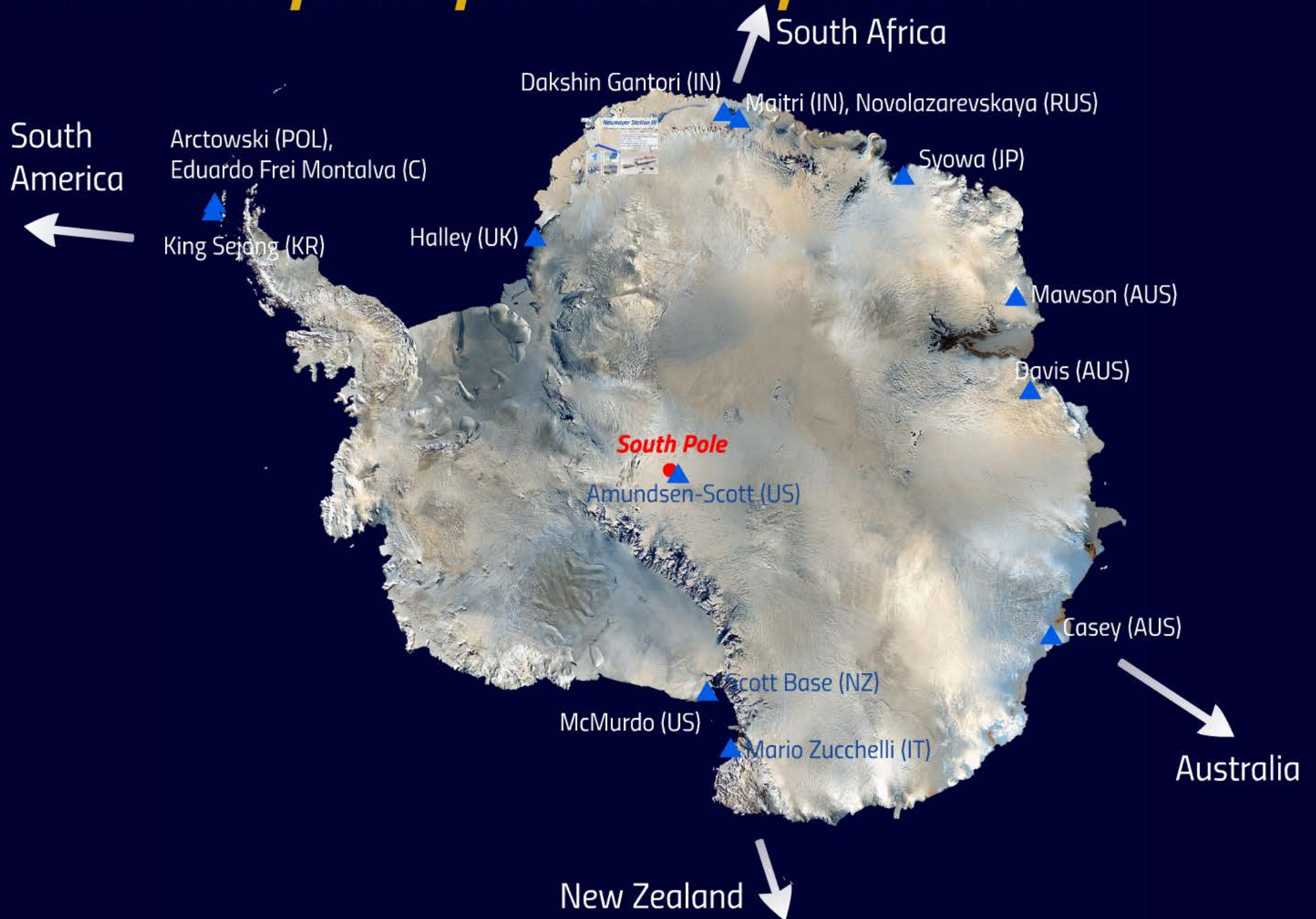
Inhospitable environment

High winds, heavy snow fall, very low temperatures, seasonal dark periods

Habitat interface

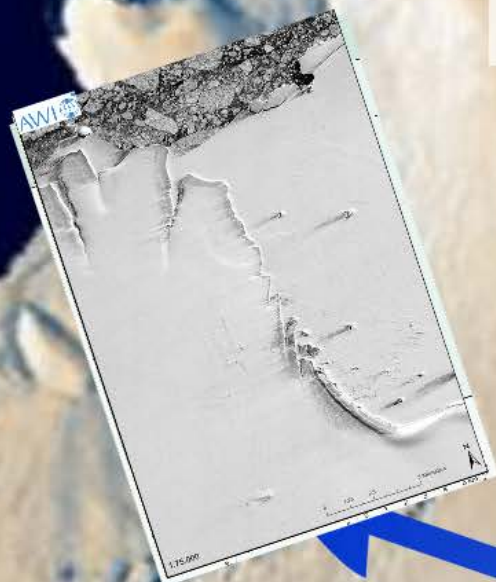
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Antarctic plant production facilities

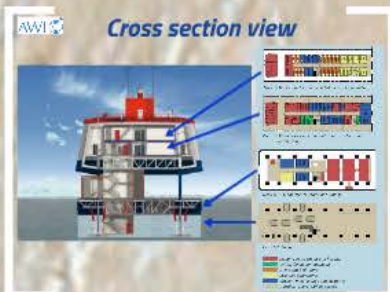


Neumayer Station III

Alfred-Wegener-Institute for Polar and Marine Research (AWI)



Protected area: 4,473 m² across four decks
 Air-conditioned area: 1,850 m² across three decks
 Weight: approx. 2,300 tons
 Accommodation: 15 rooms, 40 beds
 Laboratories and offices: 12 rooms
 Power supply: 3 Diesel generators (150 kW each)
 1 Wind power plant (30 kW)



Building Phase



End of 2007



Jan. 2008



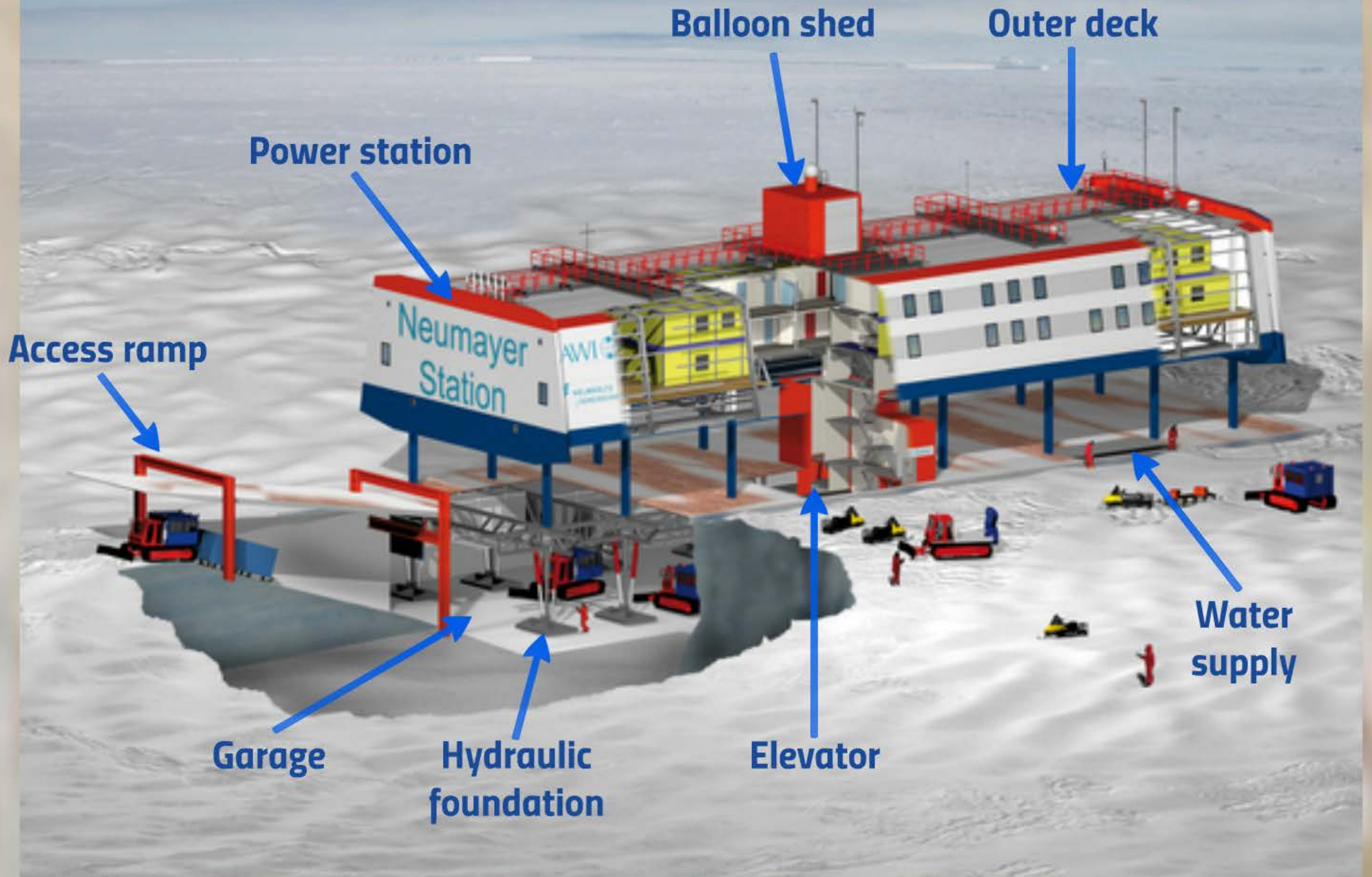
Jan. 2008



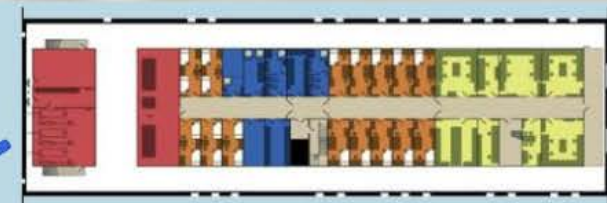
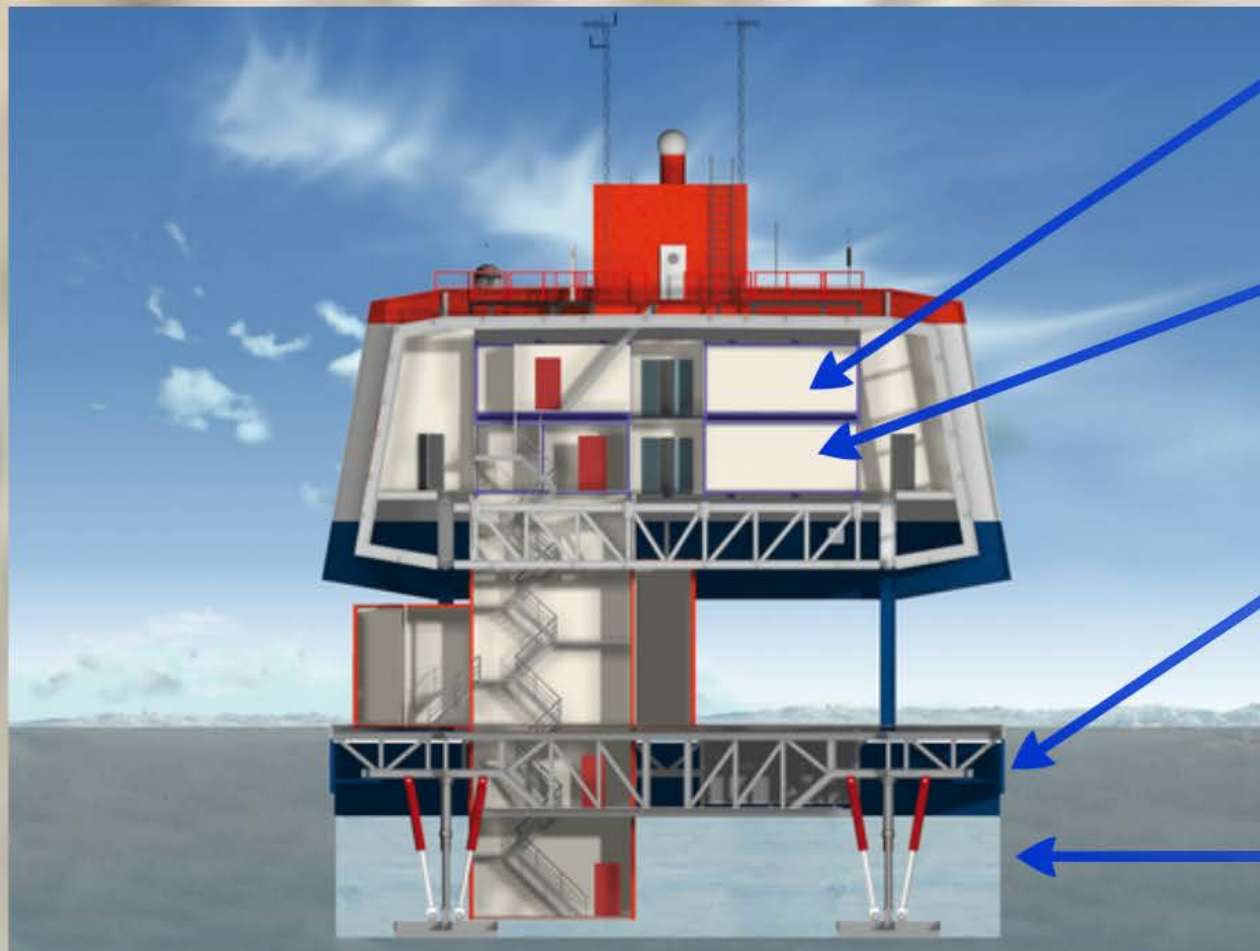
End of 2008



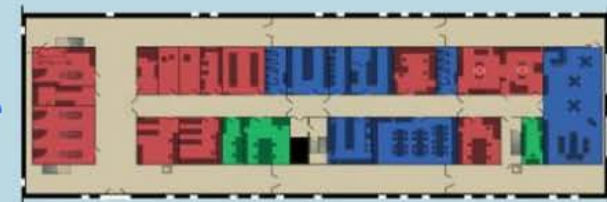
Feb. 2009



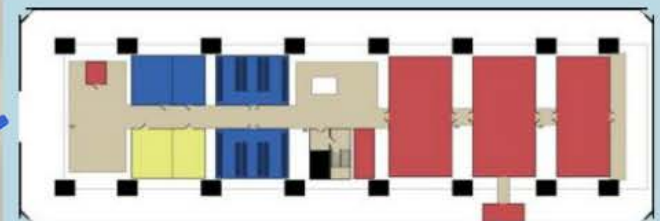
Cross section view



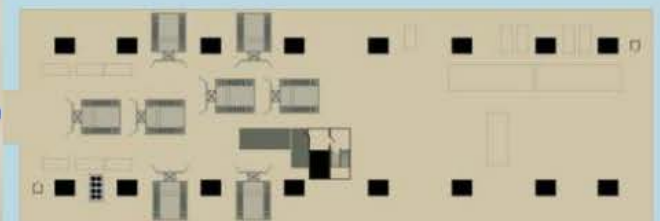
Deck 2: Station services, accommodations and laboratories



Deck 1: Station services, communications, social rooms and hospital



Deck U1: Station service rooms and storage



Deck U2: Garage

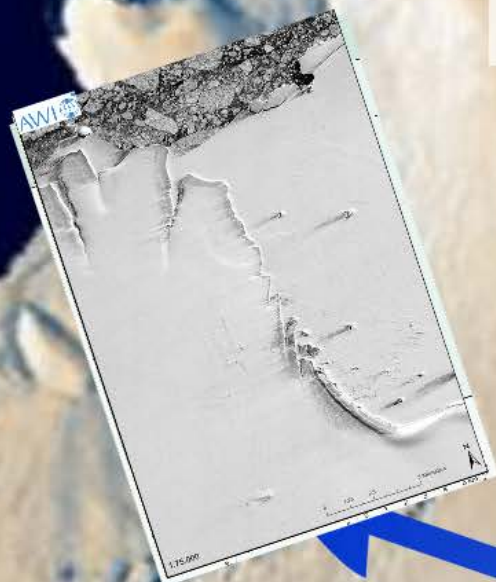
- Station service rooms and hospital
- Offices for station operation
- Living and bed rooms
- Scientific laboratories
- Kitchen, mess, lounge and lavatories
- Corridors, stairs, parking spaces

Logistics

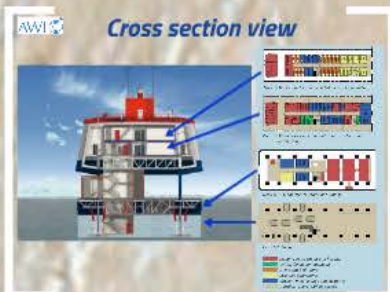


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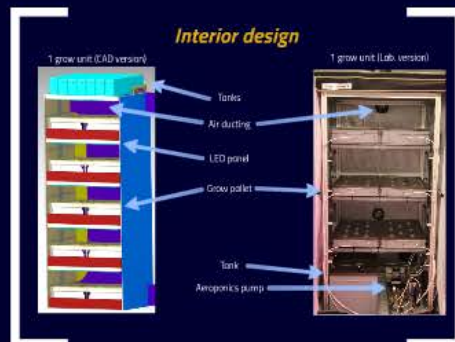
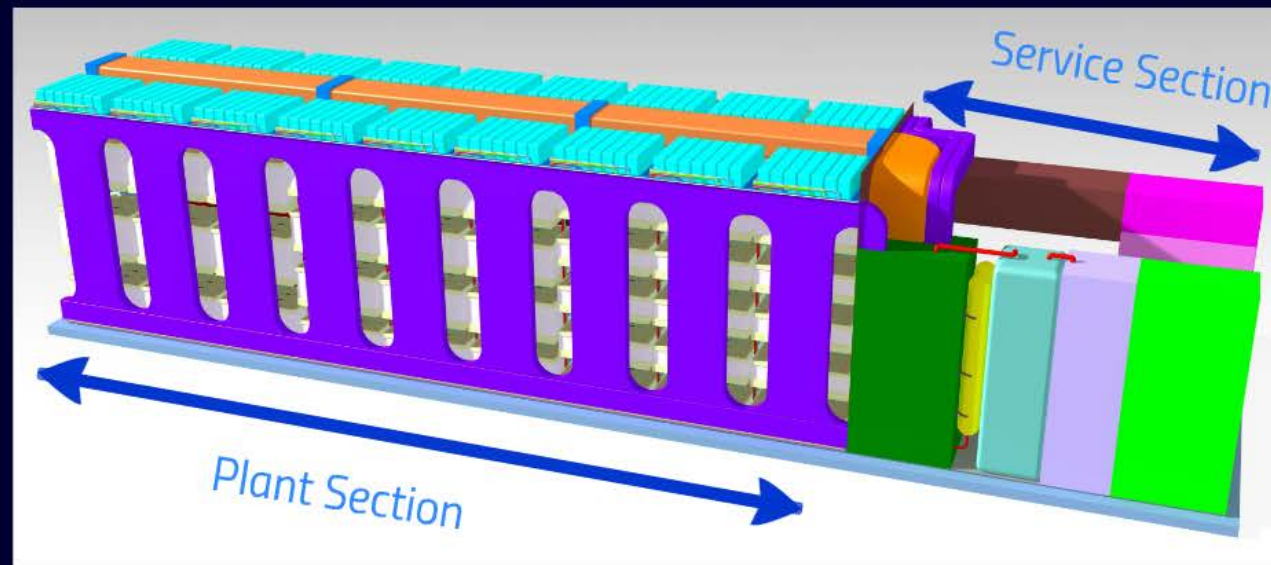
Greenhouse facility design

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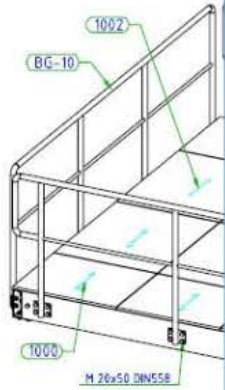
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Platform design



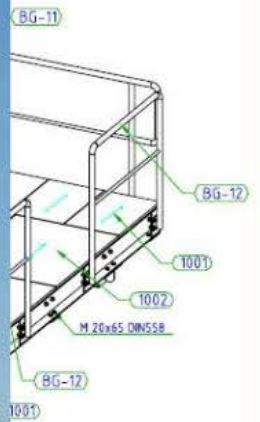
BG

BG-6

BG-25

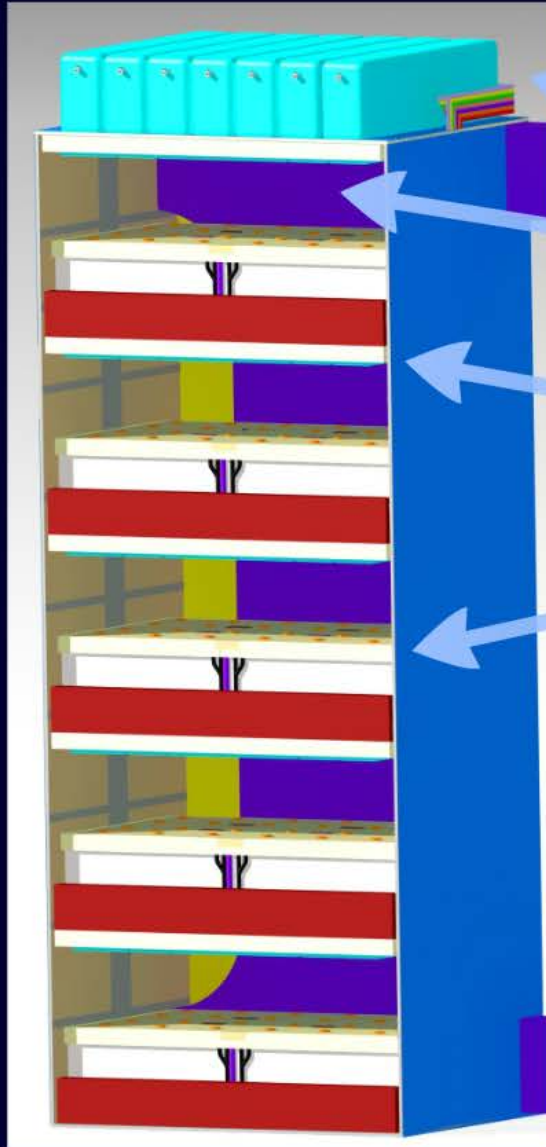
M 20x50
M 10x160 D

BG-



Interior design

1 grow unit (CAD version)



1 grow unit (Lab. version)



Tanks

Air ducting

LED panel

Grow pallet

Tank

Aeroponics pump

Opportunity

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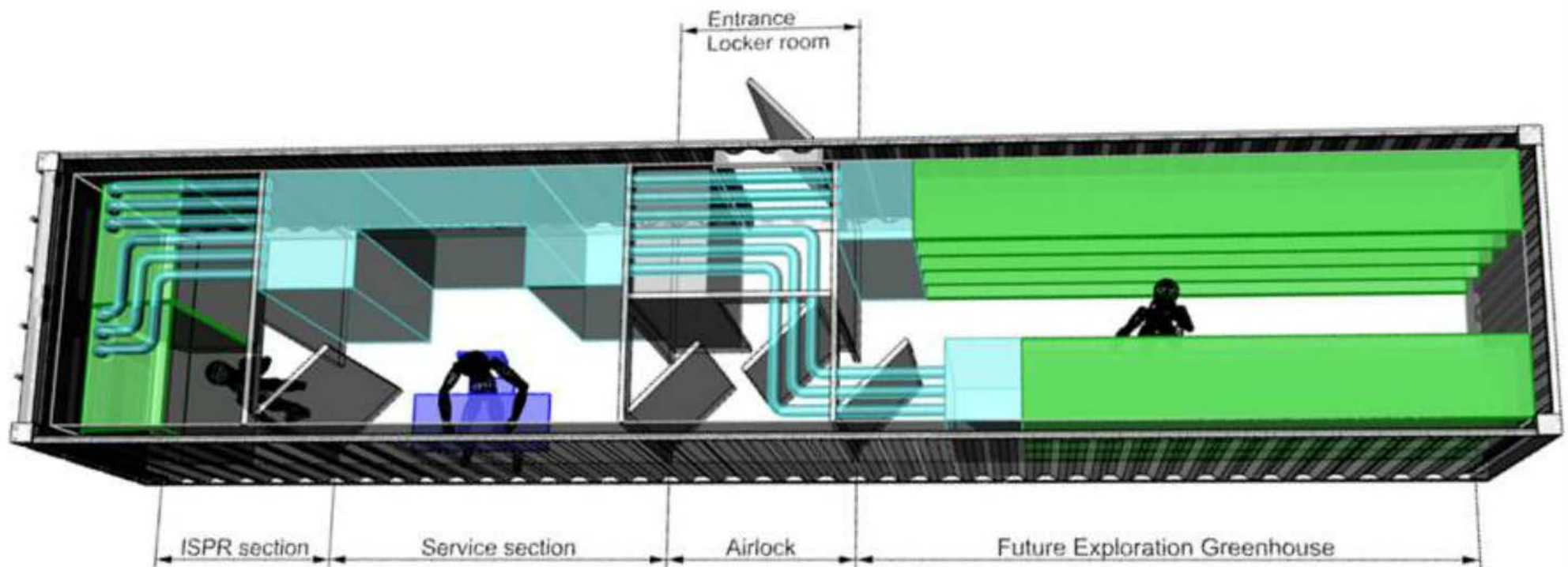
Partners:



SAB:



Opportunity



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